least about 99.9 wt % isopropyl alcohol", in the context of the claimed invention, can be reasonably ascertained by one skilled in the art in view of both the present specification and the prior art. The present invention is directed to a process for producing **high purity** isopropyl alcohol (IPA) having a metals content of less that about 1 ppb (0.000001 wt %) and a water content of less than about 100 ppm (0.01 wt %). By defining the concentration of the other components in the ultra pure IPA of the present invention, the scope of the concentration of the IPA can be reasonably ascertained by one skilled in the art. In addition, the prior art cited by the Action, in particular U.S. Patent No. 5,868,906 to Adams et al. (Adams), further defines the term "ultrapure" IPA as meaning, in relevant part, having 1 ppt to 1 ppb of any specific trace impurity such as metals, anions and cations, and having 10 ppt to 10 ppm of any other specific trace organic substances (col. 1, lines 44-53). Adams also defines the term "ultradry" IPA as having between a high of 100 ppm and a low of 0.1 ppm of water in the IPA (lines 54-56).

Clearly, one skilled in the art of producing high purity IPA, as in the present invention, would reasonably be apprised of the scope of the term "at least about 99.9 wt % isopropyl alcohol", as recited in claim 1, as well as claims 10, 11 and 20. Therefore, it is respectfully submitted that this term is definite under 35 U.S.C. §112, second paragraph, and as such, Applicants respectfully request reconsideration and withdrawal of this rejection.

(b) The Action states that claim 1 (c), (i) and (ii), as recited, are inconsistent with claim 1 (b) recitation. The Action also states that claim 1 (b) would presuppose taking out the IPA as an overhead stream, whereas claim 1 (c) (i) and (ii) would presuppose taking out IPA as a side stream either below the feed stream but above the bottoms stream or above the feed stream but below the overhead stream.

It is respectfully submitted that the process steps of claim 1 are consistent with each other and that the subject matter of the present invention is distinctly claimed. The claimed process is clearly set forth on page 6, line 10 to page 7 line 4, and page 8, line 16 through page 9, line 6 of the present specification, in conjunction with Figures 1 and 2 of the present invention. As recited in claim 1, the dry IPA is fed into the separation column. The IPA is then separated in the separation column into an overhead stream having IPA and a bottom stream having IPA, as

recited in claim 1 (b). **In addition to the overhead stream and the bottom stream, both of which do not have ultra pure IPA, a vapor side stream exists for removing the ultra pure IPA of the present invention from the separation column, as recited in claim 1 (c) (i) and (ii).** The vapor side stream location is carefully determined to ensure that the IPA stream selected is high in purity and quality (page 9, lines 3-6). Contrary to the contention in the Action, it is clear that the recitation in claim 1 (b) is consistent with that recitation of claim 1 (c) (i) and (ii), as evidenced by the detailed description of the claimed process in both the specification and Figures 1 and 2. Thus, reconsideration and withdrawal of this rejection is respectfully requested.

(c) The Action states that the colons in the Markush language of claims 2-3, 5-6, 12-13 and 15-17 should be deleted, but provides no basis for this requirement. It is respectfully submitted that these claims, as written, particularly point out and distinctly claim the subject matter which Applicants regard as the invention, consistent with §112, second paragraph. Applicants are unaware of any requirement with respect to the use of, or prohibition from using semicolons in a claim with a Markush language, especially under §112, second paragraph.

(d) The Action states that claim 9, as recited, provides for ambiguity. The Action queries what the difference is in wt. % between the overhead and the bottoms stream for separation and what constitutes the bottoms stream within the context of the claimed invention. It is respectfully submitted that claim 9, as amended, clearly recites the wt. % of both the overhead stream and the bottoms stream. As recited, the overhead stream includes about 5 to 30 wt.% of the feed stream and the bottoms stream includes about 5 to 30 wt.% of the feed stream.

As set forth in the specification, in conjunction with Figures 1 and 2, when the feed stream is introduced in the separation column, it is divided into three streams, namely the overhead stream, the bottoms stream, and the vapor sidestream. Of the total weight of the IPA feed stream, about 5 to 30 wt.% exits the separation column via the overhead stream, about 5 to 30 wt.% exits the separation column via the bottoms stream, and the remainder is taken from the separation column as a vapor sidestream (page 6, lines 10-15 and Figs. 1 and 2). In addition, the bottoms stream is clearly defined in the specification as having the amount of the feed stream, as

set forth above, in addition to having increased concentrations of components having a boiling point greater than IPA (page 8, lines 13-14). Therefore, it is respectfully submitted that claim 9 is not ambiguous and, to the contrary, distinctly claims the subject matter of the invention.

(e) The Action states that claim 10 provides for confusion because the ternary azeotrope was not specified in the claims. The Action also queries as to what are the overhead and bottoms stream products of the distilling step. It is respectfully submitted that the term ternary azeotrope is not only a term that would be reasonably understood by one skilled in the art, it is clearly described in the specification at page 7, lines 20-23. Therefore, claim 10 is definite and distinctly claims the subject matter of the invention. In addition, claim 10 does not recite overhead and bottoms stream products of the distilling step, therefore, there can be no confusion in this regard with claim 10. The distilling process used to produce the at least about 99.9 wt.% IPA used as the feed stream in the process of claim 1 is clearly described on page 7 of the present specification.

Claims 1 through 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 4,788,043 to Kagiyama et al. (Kagiyama) or U.S. Patent No. 5,585,527 to Marker with or without U.S. Patent No. 5,868,906 to Adams et al. (Adams).

Claim 1 recites a process for producing high purity isopropyl alcohol comprising the steps of (a) feeding a feed stream comprising at least about 99.9 wt.% isopropyl alcohol into a separation column; (b) separating the isopropyl alcohol into an overhead stream taken overhead from the separation column and a bottoms stream taken as bottoms from the separation column; and (c) removing the high purity isopropyl alcohol at a point: (i) below where the feed stream enters the separation column but above the bottoms stream, or (ii) above where the feed stream enters the separation column but below the overhead stream. The high purity isopropyl alcohol has a metals content of less than about 1 ppb and a water content of less than about 100 ppm.

Claim 11 recites a process for producing a high purity isopropyl alcohol comprising the steps of: (a) feeding a feed stream comprising at least about 99.9 wt.% isopropyl alcohol into a separation column; and (b) separating the isopropyl alcohol into an overhead stream taken

overhead from the separation column and a bottoms stream taken as bottoms from the separation column. The overhead stream comprises the high purity isopropyl alcohol having a metals content of less than about 1 ppb and a water content of less than about 100 ppm.

Kagiyama discloses a process for purifying a **waste organic solvent**, such as IPA, used in semiconductor manufacturing. The waste organic solvent to be purified is an organic solvent containing water, an acid, other electrolytes and particles. The water content is in the range of 10 to 40% by weight. The process to purify the waste organic solvent is a two stage process that includes pervaporation and distillation.

Marker discloses a continuous distillation and membrane separation process. In one embodiment, the stream to be separated is a mixture of IPA and water, typically from an IPA production process where the **water is present, for example, in an amount about 82 mass%.** The process uses a single vessel having both distillation and membrane separation capabilities.

Adams discloses a method for the on-site reprocessing of **waste IPA** generated in semiconductor manufacturing to an ultradry and ultrapure level. The method includes the use of a pervaporation step followed by double distillation.

It is respectfully submitted that claim 1 defines an invention that is neither disclosed nor suggested by the cited references either alone or in combination. The process of the claimed invention requires a feed stream having at least about 99.9 wt.% IPA. To the contrary, the processes disclosed in the cited references are all for the purification of a feed stream of waste IPA having far less than 99.9 wt.% IPA. As set forth in Kagiyama, the water content in the waste organic solvent (IPA) is in the range of 10 to 40 wt.%, thus the IPA concentration can be no more than 90 wt.% (col. 4, lines 25-27). Even after purification by the inventive process of Kagiyama, the purified IPA has a concentration of 99.7 wt.%, which is not as pure as the IPA feed stream of the claimed invention or of the resulting purified IPA of the present invention, which has less than 100 ppm water present. Moreover, the purified IPA distillate of Kagiyama has 0.02 ppm of Na ions, 0.003 ppm of K ions, 0.003 ppm of Fe ions and 0.001 ppm of Cu ions. This is contrary to the high purity IPA produced by the claimed process of the present invention,

which has a metals content of less than 1 ppb. As set forth in the present specification, there is a demand for ultrapure IPA, as in the present invention, for use in the semiconductor manufacturing industry.

In addition, the process in Kagiyama clearly does not disclose or suggest removing high purity IPA at a point either below where the feed stream enters the separation column, but above the bottoms stream, or at a point above where the feed stream enters the separation column but below the overhead stream, as recited in claim 1. As clearly set forth in the specification, by carefully removing the IPA from the separation column at one of these points, a high purity IPA is produced. To the contrary, the distillation process disclosed in Kagiyama does not remove the IPA from a point between the overhead stream and above the bottoms stream. The IPA in Kagiyama is removed from an overhead stream line.

Like Kagiyama, Marker fails to disclose or suggest a process by which the feed stream to be purified has at least about 99.9 wt.% IPA, as recited in claim 1. To the contrary, the stream to be purified in Marker is about 82 mass % water and **only 18 mass % IPA.** In addition, Marker also fails to disclose or suggest a process in which the high purity IPA is removed from a point between the overhead stream and the bottoms stream in the separation column. As pointed out above, selecting the proper point of discharge is critical to producing high purity IPA having less than 100 ppm water and less than 1 ppb metals, as in the claimed invention.

It is respectfully submitted that Adams fails to cure the deficiencies in both Kagiyama and Marker, in that it also fails to disclose or suggest a process for producing high purity IPA by feeding a feed stream having at least about 99.9 wt.% IPA into a separation column, and removing high purity IPA from a point in the separation column between the overhead stream and the bottoms stream to produce an IPA with less than 100 ppm water and less than 1 ppb metals content, as recited in claim 1. To the contrary, Adams produces ultradry and ultrapure IPA with a series of pervaporation and distillation steps, none of which remove high purity IPA from a point in the separation column below the overhead stream and above the bottoms stream, as recited in claim 1. To the contrary, the ultrapure and ultradry IPA produced by Adams is removed from the overhead stream in both distillation columns used.

It is also respectfully submitted that claim 11 defines an invention that is neither disclosed nor suggested by the cited references either alone or in combination. Claim 11 also recites a process for producing high purity IPA requiring feeding a feed stream comprising at least 99.9 wt.% IPA in a separation column, like claim 1. As stated above, clearly none of the cited references disclose or suggest a process with such a feed stream. To the contrary, the feed streams in the cited patents are laden with 10% or more water, as the streams to be treated are waste streams from semiconductor processing. Moreover, none of the cited references disclose or suggest a process for producing a high purity IPA having a metals content less than 1 ppb and a water content less than about 100 ppm in a process that employs a single separation column, as recited in claim 11. To the contrary, the process in each cited reference requires multiple purification process, such as, a pervaporation and a distillation process (Kagiyama), a distillation, membrane separation and second distillation process (Marker), and a pervaporation and double distillation process (Adams), unlike the claimed invention.

In summary, it is submitted that the pending claims are clearly patentable over the cited references. It is respectfully submitted that the claims avoid the rejections set forth in the Office Action, and thus place the claims in condition for allowance.

Reconsideration and withdrawal of all rejections of the claims are respectfully requested.

November 1, 2001

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DETAILED REVISIONS TO SPECIFICATION AND CLAIMS

IN THE SPECIFICATION

The Abstract of the Disclosure paragraph beginning on page 19, line 5 has been replaced with the following rewritten paragraph:

--A process for producing high purity isopropyl alcohol. In one embodiment, the process [comprising] includes the steps of: (a) feeding a feed stream comprising at least about 99.9 wt.% isopropyl alcohol into a separation column; (b) separating the isopropyl alcohol into an overhead stream taken overhead from the separation column and a bottoms stream taken as bottoms from the separation column; and (c) removing the high purity isopropyl alcohol at a point: (i) below where the feed stream enters the separation column but above the bottoms stream, or (ii) above where the feed stream enters the separation column but below the overhead stream [, wherein]. [t]The high purity isopropyl alcohol has a metals content of less than about 1 ppb and a water content of less than about 100 ppm. Optionally, the process includes the step of passing the high purity isopropyl alcohol through an ion exchange resin after removing the high purity isopropyl alcohol from the separation column, thereby forming an ultra-high purity isopropyl alcohol that contains less than 100 ppt of any metal impurity.--

IN THE CLAIMS

Claim 9 has been amended as follows:

9. The process of claim 8, wherein said overhead stream [is] comprises about 5 to 30 wt.% of [the weight of] said feed stream and said bottoms stream [is] comprises about 5 to 30 wt.% of [the weight of] said feed stream.